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ABSTRACT

The purpose of this study was to determine the effects of the Future Problem Solving Program on gifted students' ability to solve futuristic problems. Two specific research questions were asked. The first question dealt with the effects of the Future Problem Solving Program on subjects' total score on an ill-structured problem. Question two asked which components of the Future Problem Solving process differed across groups. Subjects were fourth- and fifth-grade gifted children in a suburban school district (Southeast Texas). Thirty-three students assigned to treatment had participated in the Future Problem Solving Program for at least 6 months, while the 28 control subjects were non-participants in this program. All subjects attended a Mock Future Problem Solving Bowl and completed a problem booklet similar to those used in the program. Results of analysis indicated a significant effect for treatment on total score. In addition, there were significant differences among four of the six components across groups. There was a significant overall effect for the Future Problem Solving Program on the solution of futuristic problems similar to those used in the program. With the knowledge that the subjects did not differ in their performance on two components of the process, "best solution" and "plan for acceptance", the conclusion was drawn that it is possible that experimental subjects, who had knowledge of the evaluation procedures, concentrated more on components that had a higher possible score than these two components. (Author/CL)

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The Future Problem Solving Program:

An Investigation of Effects on Problem Solving Ability

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Running Head: FUTURE PROBLEM SOLVING

Abstract

The purpose of this study was to determine the effects of the Future Problem Solving Program on gifted students' ability to solve futuristic problems. Two specific research questions were asked. The first question dealt with the effects of the Future Problem Solving Program on subjects' total score on an ill-structured problem. Question two asked which components of the Future Problem Solving process differed across groups. Subjects were fourth- and fifth-grade gifted children in a suburban school district. Thirty-three students assigned to treatment had participated in the Future Problem Solving Program for at least six months, while the twenty-eight control subjects were non-participants in this program. All subjects attended a Mock Future Problem Solving Bowl and completed a problem booklet similar to those used in the program. Results of analysis indicated a significant effect for treatment on total score. In addition, there were significant differences among four of the six components across groups. There was a significant overall effect for the Future Problem Solving Program on the solution of futuristic problems similar to those used in the program. With the knowledge that the subjects did not differ in their performance on two components of the process, "best solution" and "plan for acceptance", the conclusion was drawn that it is possible that experimental subjects, who had knowledge of the evaluation procedures, concentrated more on components that had a higher possible score than these two components.

The Future Problem Solving Program:
An Investigation of Effects on Problem Solving Ability

Many researchers believe that problem solving can and should be taught directly (DeBono, 1983; Shaw, 1983; Simon, 1980; Steinberg, 1983; Sternberg, 1981; Wright, 1981). Many highly intelligent individuals often seem to be rather ineffective thinkers, better at reactive thinking than thinking about topics requiring a broader view (DeBono, 1983).

Several investigations have been conducted in order to determine the efficacy of direct instruction in problem solving (Basadur, Graen, & Green, 1982; Berry, 1983; Houtz & Feldhusen, 1976; Steinberg, 1983; Sweller, Mauer, & Howe, 1982; Weisberg & Alba, 1981; Wicker, Weinstein, Yelich, & Brooks, 1978). Examination of the literature reveals several studies on creative problem solving or work with open-ended or ill-structured problems. These are real-life problems that are not as clearly stated as well-structured problems. The problem solver must find the needed information from a much larger pool of information than for well-structured problems, and there may be more than one correct answer, only varying degrees of quality in the response (Simon, 1973).

Houtz and Feldhusen (1976, 1977) examined effects of a problem-solving training program for 240 fourth graders using tasks that called for students' use of the abilities needed for creative problem solving. Students were from 12 classrooms in six schools. Each class was randomly assigned to one of three groups: (1) training plus rewards with free time and games, (2) training only and (3) a control group who took part in regular class activities. In the two training

groups, lifelike cartoon drawings of children and sometimes adults in problem situations were presented to students in a worksheet format 15-30 minutes per day for nine weeks with a total of 43 worksheets used. Students were asked to respond to each drawing and its verbal description by thinking of as many answers as they could relating to the specific ability to be measured. For example, some worksheets called for listing causes, some called for consequences, and so on until all 12 abilities had been covered. There were significant effects for both experimental groups with the training-only group outperforming all others on the problem-solving test. The same effects occurred for the training-only group on what the researchers' considered a test of transfer. This was a very similar problem to those used in the training. However, the cartoon pictures were eliminated, and only a verbal description was given. Further analysis revealed that worksheet scores significantly differed over time for the three groups. The nine-week period of training was divided into three two-week and one final three-week section. By the sixth week the training-only group was already outperforming the training-plus-reward group.

Another study on creative problem solving was conducted by Jaben (1979) to determine effects of a problem-solving training session on fifth- and sixth-grade learning disabled students, all reading on the third-grade level. The tasks for training were based on a creative problem solving format adapted from the Osborn/Parnes creative problem solving model (Parnes, Noller, & Biondi, 1977). Students were randomized into an experimental training group (n=25) and a control group without training (n=24). Results indicated that the

experimental group significantly outperformed the control group on measures of fluency, a pivotal ability in creative problem solving.

In a study with educable mentally retarded 10-12 year olds, Gold and Houtz (1984) reported significant treatment and maintenance effects for 60 subjects in an experimental group. These subjects had received nine weeks of training using an adaptation of the Productive Thinking Program. Each lesson, presented once a week, centered on a complex problem presented in story form which the student is asked to solve. The experimental group significantly outperformed the 60 control group subjects on a verbal and a figural subtest of the Torrance Tests of Creative Thinking, and maintained this lead four weeks later on alternate forms of the same subtests. These tests measure fluency, flexibility, and originality.

Harris and Blank (1983) also sought to determine the effects of the Productive Thinking Program. They also used Blank's Creative Problem Solving Program to determine effects on several abilities for fifth-grade students. Subjects were divided into four groups in two schools. In one school, 25 subjects were in the Productive Thinking Program group and 24 subjects were in the Creative Problem Solving Program group. The Creative Problem Solving Program dealt only with what was called a Pre-Task Phase of setting a climate for creativity. Results revealed a significant difference between the two programs in favor of the Creative Problem Solving Program on four measures. These were asking questions, solving complex problems (fluency and number of questions), solving real-life problems familiar to elementary students (fluency and hypothesis generation), and verbal originality on the Torrance Tests of Creative Thinking. All groups showed an increase on

problem solving skills, question asking and attitudes toward problem solving. There was no control group used in this study.

There has been other work on evaluation of programs that purport to teach problem solving skills. Mansfield, Busse, and Krepelka (1978) have provided an extensive review of research on three such programs: the Productive Thinking Program, the Purdue Creative Thinking Program, and the Osborn/Parnes Creative Problem Solving Model. They cite studies that have been conducted on each of these programs. The results of these studies showed that participants exhibited improvement in creativity test scores due to participation in the programs. However, for the Purdue Creative Thinking Program and the Productive Thinking Program there have been some studies that show no improvement in creativity test scores. Mansfield et al. also cite methodological deficiencies with studies conducted on the Osborn /Parnes program because subjects in these experiments had volunteered for training. One of the few studies that used a test of problem solving as a criterion measure was that done by Treffinger, Speedie, and Brunner (1974). They compared the Productive Thinking Program and the Purdue Creative Thinking Program and found that there was no growth in ability to solve real-life tasks as a result of training in either program. D. J. Treffinger (personal communication, December 1, 1984) believes that one of the problems in such a study is the difficulty in devising an appropriate real-life problem solving task to test effects of training.

Another program for teaching problem-solving skills to children using ill-structured futuristic problems is the Future Problem Solving Program established in 1974 by E. Paul and J. Pansy Torrance (Stewart,

1984). This program, based upon the problem-solving process employed in the Osborn/Parnes Creative Problem Solving Model, provides an excellent arena for research. As yet, there have been no studies reported on this program that serves over 100,000 students throughout the country (A. B. Crabbe, personal communication, May 24, 1984).

The Future Problem Solving Program, designed to meet the needs of gifted children, includes an interscholastic competition (Stewart, 1984). The goals of this program are: (1) to encourage gifted students to begin looking for solutions to problems they will encounter in the future; (2) to enhance creative thinking and problem-solving skills; (3) to encourage the development of writing and verbal communication skills; and (4) to facilitate interaction of students of equal ability level (Torrance, Bruch, & Torrance, 1976). Students work in teams of four to create solutions to open-ended problems. They may enter the competition in one of three divisions: junior (grades 4-6), intermediate (grades 7-9), or senior (grades 10-12). Three practice problems are sent to coaches who help supervise their teams in creating solutions to the problem situations that are typically scenarios of problems in a setting usually at least 25 years in the future (Torrance, Torrance, & Crabbe, 1983). Coaches may receive training from experienced coaches or from trainers who are endorsed by one of the state offices or the national office of the Future Problem Solving Program.

Training provided by the coaches for students who participate in the program involves the teaching of strategies that can facilitate problem solving and subsequent practice in problem-solving steps. This training normally includes the teaching of strategies to improve

creativity and aid in ideation.

Besides the teaching of creativity strategies, a typical series of training sessions might entail training to improve performance on each of the six steps or components in the Future Problem Solving process. These components are problem identification, statement of the problem, alternative solutions, evaluation of solutions, statement of the most promising solution, and elaboration of the final plan to gain acceptance of the solution. After being taught the problem-solving process, teams of students proceed through the six components and solve the problem aloud as a group, talking each other through each component and hitchhiking on each other's ideas. Students then submit a transcript of their ideas on each component of the process for each practice problem to a trained team of outside state evaluators after each of the three practice problems have been completed. They receive written evaluations, including numerical scores on each component as well as a total score which is the sum of component scores. They also receive written feedback on their performance, and may use the feedback to improve their performance on subsequent problems.

Some participants as well as teachers who have worked with the Future Problem Solving Program have informally asserted that there are several positive effects. Some believe that students who have participated are better able to work together in groups and become more effective in written communication and in applying other skills learned in the program to subject-matter skills. Many also report that they think that children who participate become better problem solvers. However, no empirical studies have been reported to verify

these beliefs.

In order to begin to investigate effects of the Future Problem Solving Program's goal of enhancing problem-solving skills, one must first determine whether students who participate in the program are able to transfer what they have learned to problems similar to those upon which they are trained. In the present study, an attempt will be made to do this. The purpose of this study is to determine whether there is a significant effect on gifted students' abilities to solve futuristic problems as they are defined in this program. This study sought to find whether gifted students who participate in the Future Problem Solving Program for at least six months learn to solve futuristic problems similar to those used in the Future Problem Solving Program better than nonparticipants who are also gifted. The first question to be answered is whether there is a significant difference between groups on the total booklet score, and the second question is over which component scores the two groups may differ.

Methods

Subjects

The subjects for this study were 61 gifted children. Of these children, 29 were in the fourth grade and 32 were in the fifth grade in 12 elementary schools in a suburban school district in Southeast Texas. Most were of middle and high socioeconomic status, and all were participating in a gifted program. Gifted students were sought as subjects in this study, because of the relevance of this population to the goals of the Future Problem Solving Program.

Thirty-three of the 61 subjects had participated in the Future Problem Solving Program for at least six months and had completed at

least two and no more than three practice problems for evaluation and feedback. The remaining 28 subjects had not participated in the Future Problem Solving Program but had participated in a gifted program. The 33 students who had been Future Problem Solving participants were called the experimental group or the Future Problem Solving group. The 28 subjects, who had not been participants in Future Problem Solving, were called the control group. These 61 subjects volunteered for this study by accepting an invitation to attend what was advertised as a Mock Future Problem Solving Bowl.

Variables

The seven dependent variables that were selected to test the effects of the Future Problem Solving Program were the sum of the component scores, called the total score, and the scores for each of the six components in the process. These are problem identification, problem statement, alternative solutions, solution evaluation, most promising solution, and final plan to gain acceptance.

The score for component one, problem identification, is composed of three measures. These are for fluency, flexibility, and quality of problem ideas. Component two, statement of the problem, is scored according to completeness and significance. Fluency, flexibility, originality, and elaboration are measures used for component three, alternative solutions. Component four, evaluation of solutions, uses measures consisting of one overall score for an evaluation chart and two scores for relevant and correctly-used criteria. The fifth component, most promising solution, is evaluated according to its relevance to the stated problem and its constructiveness and humaneness. Finally, the sixth component, the final plan to gain

acceptance, is scored for its adequacy.

Materials and Instruments

Educational Abilities Series (EAS). This test provides an estimate of educational ability in a short administration period. Subtests include picture vocabulary, word vocabulary, numbers (i.e. minutes in an hour, etc.), and picture grouping. These subtests are for the Level D, Form 1 of the EAS administered to subjects in this study (Thurstone, 1978).

Computers-in-the-Home-Problem. This problem or "fuzzy situation", as it is called in the Future Problem Solving Program, was one that was used in 1981 by students who participated in the Future Problem Solving Program in the junior division.

> The problem statement given to the subjects was as follows: Your assignment is to consider yourself as a member of a representative committee who has been asked by the local School Board to be a consultant for a very difficult problem which has arisen in your community. Because all the families in your community have home or microcomputers, the School Board has discontinued the local school system and all teaching is done by computers. However, just as the "olden days" of 1980, some children are not paying attention. They prefer to play games or "goof off" by communicating with friends. The achievement test scores for all subjects have fallen so low that the School Board is considering returning all children to "the basics of 1980" where children are in an assigned classroom. (Torrance, et al., 1983, p.39)

Design and Procedure

Problem-Solving Session. Subjects first listened to a 30-minute speech given by one of the Texas Future Problem Solving Program managers. She spoke of ways to think futuristically and engaged the students in several activities designed to help them do so. There was no practice on any of the components of the Future Problem Solving process. The purpose of this talk was to entice the subjects to attend the Mock Bowl by allowing them to hear from a state program manager of the program.

Following this lecture, all subjects were given two hours to complete a problem booklet on a computers-in-the-home problem. The rationale for choosing this particular problem was that it was believed that students would already be familiar with microcomputers and would be aware of some problems in education. Therefore, extensive research to gain knowledge in the problem area would not be needed. The booklet that students used to record answers, was identical to those used in the Future Problem Solving Program in their state. Although children who participate in the Future Problem Solving Program work in teams of four, each subject in the current study was required to complete the problem booklet alone. This completed problem booklet was used as the posttest representing the seven dependent variables described earlier.

Five adult monitors, including the researcher, observed the problem-solving session and were available to answer questions. Shortly after the two-hour session began, several control-group subjects expressed confusion concerning the problem situation. In order to eliminate this confusion, monitors explained the situation to

all subjects. As the session proceeded, some control-group subjects questioned the directions on component four of the process, the evaluation of solutions. They did not know the definition of "criteria" or what it meant to be asked to rank solutions according to criteria. At this point, monitors explained this component to all subjects using examples from other sample problems. The researcher concluded that, because all subjects received the same explanation, no contamination of the study occurred.

Pretest. This quasi-experimental study used the Cook and Campbell (1979) Untreated Control Group Design with Proxy Pretest Measures. The score on the Educational Ability Series test from the Science Research Associates Achievement Test (Thurstone, 1978) was used as the pretest in this study. All subjects had completed this test as of September of the school year, approximately eight months prior to the problem-solving session. This pretest measure was chosen to prevent the threat to internal validity of pretest sensitization that might have occurred if a problem booklet similar to that used in the posttest had been used as a pretest.

Evaluation of Problem Booklets. Scoring of the problem booklets was accomplished by six evaluators. These evaluators had served as official Future Problem Solving Program evaluators on more than two occasions. The booklets were scored using the criteria established in the Future Problem Solving Program (Classen, 1984). Each evaluator used guideline sheets, prepared by the Texas Future Problem Solving Program managers, which delineated the proper criteria for scoring each component.

In a two-block design, evaluators were randomly assigned in

threes to each block. The design was used for purposes of evaluating interrater reliability. Booklets were randomly assigned to blocks with half of the experimental group booklets and half of the control group booklets randomly assigned to each block. Three raters in Block 1 scored the same 16 experimental group and the same 14 control group booklets. The other three raters scored the remaining 17 experimental booklets and the remaining 14 control booklets. Therefore, each booklet was scored by three evaluators, and the evaluators were not aware of which booklets belonged to the experimental or the control groups.

Results

Question One

Question one of the study was whether or not a significant difference would occur between the experimental and control groups on the problem booklet total score. Each student's score used in calculation was the average of the scores given by three raters who were blind to group membership. The mean and standard deviation for the experimental group were 76.96 and 30.10, respectively. For the control group, the mean was 44.74 with a standard deviation of 21.30. It can be seen from these results that the experimental group had a higher mean score than the control group, and the standard deviations significantly differed from each other, $F=2.00$, $df=33,28$, $p<.05$.

An initial Analysis of Covariance (ANCOVA) was performed and it was decided that the covariate measure would not be used for data analysis, because it accounted for less than one percent of the total variance. The means for the Educational Abilities Series were 132.4 for the experimental group and 132.8 for the control group. Because

the ANCOVA was not used, there was no need to use the Johnson Neyman Procedure as had been planned. Rather an Analysis of Variance (ANOVA) procedure was employed to test for the effects of the Future Problem Solving Program on subjects' overall problem-solving performance. Table 1 contains the results of the ANOVA for the total scores for each group.

Insert Table 1 about here

The ANOVA results show a significant effect for treatment, $F=26.31$, $df=1,57$, $p<.05$. Students who participated in the Future Problem Solving Program had significantly higher total scores on the futuristic problem booklet. A significant treatment effect was found for the total score. There was no significant effect for block, $F=.29$, $df=1,57$, $p>.05$. Therefore, there was no significant difference between total scores of treatment and control group subjects randomly assigned to blocks.

There was no significant block by treatment interaction, $F=.82$, $df=1,57$, $p>.05$. There was a significant difference for evaluators nested in block, $F=17.36$, $df=4,114$, $p<.05$. Means of total scores for evaluators one through six were 76.97, 55.26, 60.65, 58.53, 57.57, and 63.83, respectively. Post-hoc analysis using the Student-Newman-Keuls indicated the contrasts between evaluator 1 and all remaining evaluators, and between evaluator 6 and evaluators 2, 3, 4, and 5 were significant. A summary of generalizability coefficients (Cronbach, Gleser, Nanda, & Rajaratnan, 1972) that were computed to determine the interrater reliability can be found in Table 2. It can be seen from

these results that the generalizability coefficients were high. This indicates low interrater reliability for all components as well as for total score on the problem booklet with the most reliability obtained for component 4, evaluation of solutions. The interaction for evaluators and treatment nested in blocks was nonsignificant, $F=2.36$, $df=4,114$, $p>.05$.

Insert Table 2 about here

Question Two

Question two of this study asked over which components of the futuristic problem the experimental and the control groups differ. Before describing the results of the analysis of the component scores across groups, it should be noted that some subjects did not complete all components in the process. In the experimental group, 21 of the 33 subjects completed all components. However, twelve subjects did not attempt component 6; nine of those subjects did not attempt component 5; and three did not attempt component 4. In the control group, 25 of the 28 subjects completed all six components of the process. Three subjects failed to complete the booklet by omitting component 6. All of these omitted components were scored as 0's.

The highest possible score (PS) for each component is listed in Table 3 along with means and standard deviations for each component and for both groups. It can be seen that the experimental group performed better on some components than others. In addition, the experimental group scored higher on most of the components of the process than the control group. Some differences among the means for

these component scores may be a consequence of the differences in possible scores among the components which range from 10 to 170.

Insert Table 3 about here

ANOVA was used to determine whether there were significant differences between the experimental and the control groups on each of the components of the futuristic problem. Table 4 contains a summary of the results of this analysis.

For the first and second components, there were significant effects for treatment, $F=17.72$, $df=1,57$, $p<.05$ and $F=27.67$, $df=1,57$, $p<.05$, respectively. The third and fourth components, also displayed a significant effect for treatment with $F=30.11$, $df=1,57$, $p<.05$ and $F=20.24$, $df=1,57$, $p<.05$, respectively. There was no significant effect for treatment for the best solution (component 5), $F=.01$, $df=1,57$, $p>.05$. There was also no significant effect for treatment for the final plan (component 6), $F=.01$, $df=1,57$, $p>.05$.

Insert Table 4 about here

In summary, there was a significant effect for treatment as indicated by the results of ANOVA on the total scores. Significant differences for evaluators with significant contrasts among evaluators and a low interrater reliability were evident from further analyses. There was a significant effect for treatment for all but two of the components.

Discussion and Conclusions

The problem for this study was to determine whether or not gifted students who participated in the Future Problem Solving Program for at least six months learned to solve futuristic problems similar to those used in the program better than gifted nonparticipants. The results of this study indicate a significant overall effect for the Future Problem Solving Program on the solution of futuristic problems. Conclusions drawn are limited to elementary gifted students who participated in a gifted program in a suburban area of Southeast Texas. They are also limited to the effects of the Future Problem Solving Program on the solution of a futuristic problem similar to those used in the program.

The Future Problem Solving Program was effective in producing higher scores on an ill-structured, futuristic problem. Elementary gifted students who had participated in the program scored higher than gifted nonparticipants. These results demonstrate a direct effect of the program on the solution of problems similar to those used in the program. In the current study, no attempt was made to assess transfer of training to other problem-solving tasks. However, because the experimental group had participated in the Future Problem Solving Program in a team situation, the completion of the problem booklets on an individual basis reflects transfer to a slightly different situation.

Further analysis of the total scores revealed a difference for evaluators in their scoring of the booklets. There were significant contrasts between evaluators despite the fact that all evaluators were highly experienced. It is possible that these trained evaluators may

require additional training or more effective training in order to become more alike in their scoring of the problem booklets. It is recommended that student booklets be scored by more than one evaluator.

Even though all other components were significantly better for the experimental group, the components, best solution and final plan to gain acceptance, did not differ between groups. These results may suggest that the experimental group members have focused on what they consider to be the most important component in terms of possible score. It may also be possible that the Future Problem Solving process does not affect the outcome and that students are able to devise an appropriate solution without proceeding through the other components.

Another issue relates to the type of training received by participants in the Future Problem Solving Program. Little is known about the exact nature of the training provided for the students by their Future Problem Solving coaches. Variable performances among participants may be attributable, in part, to the variability in the training they receive. The results of this study may have implications for modifications in training approaches that will help ensure that most students who participate in the Future Problem Solving Program perform well on all components of the process.

In conclusion, gifted students who participate in the Future Problem Solving Program are able to achieve higher scores on most of the components of an ill-structured futuristic problem than those who have not participated. Even though students may be gifted, they still may require training and practice in solving futuristic problems in

order to perform well on most of the components of the futuristic problem in the Future Problem Solving Program. It should be noted that students who participate may be sensitized to the scoring procedures and thus may be focusing on those components of the problem that receive higher scores while those who do not participate are not aware of these scoring procedures.

Future Studies

There are numerous questions that have emerged from the results of this study. This research has spoken to the ability of gifted students to perform better on futuristic problems after participation in the Future Problem Solving Program than nonparticipants. Because the Future Problem Solving Program was designed for use with gifted students, one question that is still to be answered is whether gifted students who have not participated in the program would be able to receive higher scores on the problem than non-gifted students who have participated. In addition, would the pattern of scores within this non-gifted trained group differ from the pattern within a group of gifted Future Problem Solving Program participants? A further question concerns transfer to other kinds of problems. It remains to be seen whether the participants in the Future Problem Solving Program would score as well on problems presented in a different format or on more structured problems such as analogies.

It has been mentioned that a training handbook is made available to coaches in the Future Problem Solving Program. An area left to be explored is the exact nature of the training that is done by these coaches. It is not known how consistent the Future Problem Solving

training is or which aspects of training seem to be the most effective. Training of evaluators is another related area. Because evaluators tended to disagree on their scoring, even when given detailed guidelines, it is possible that there may be more effective training approaches developed for this group. It is also possible that a standard scoring procedure could be devised that would eliminate some of the disagreement among evaluators' scores.

It will be recalled that there is a possibility that students who have participated may become sensitized to the scoring system, and thus focus on getting higher scores by concentrating on those components that are numerically important. It is not known whether this would change if a scoring system with equal weighting for each component were used or if control group subjects would have performed better if they had been made aware of the scoring system. Also, because many experimental group subjects did not complete the problem booklets, it would be interesting to conduct a similar study allowing more time or using an untimed format in the problem-solving session.

Finally, if a goal of the Future Problem Solving Program is to help gifted students explore solutions to future problems, it seems evident that the "best solution" component is an important outcome. It would be interesting to discover how outside experts would rate the subjects' solutions to the futuristic problem.

Currently, over 100,000 gifted students are participating in the Future Problem Solving Program. Several questions have been answered through the results of this study. However, there is still much to learn about the effects of this program on problem-solving ability. There is no doubt that the Future Problem Solving Program is

beneficial to many students across the country, but it seems imperative that further exploration take place in order to provide even more benefits to students of the future.

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Table 1

Analysis of Variance for Total Scores on the Futuristic Problem Booklet

Source	Sum of Squares	df	Error term	F-Ratio
Between				
Block (1)	522.12	1	(4)	.29
Treatment (2)	46772.19	1	(4)	26.31+
Block*Treatment (3)	1451.71	1	(4)	.82
ID(Blk*Treatment) (4)	101298.84	57	---	
Within				
Evaluator(Blk) (5)	8086.14	4	(7)	17.36+
Evaluator*Treatment(Blk) (6)	1098.21	4	(7)	2.35
Error (7)	13273.01	114	---	

+$p < .05$

Table 2

Interrater Reliability: Generalizability Coefficients

Variable	Generalizability Coefficient
Problem identification	.97
Problem statement	.93
Alternative solutions	.95
Solution evaluation	.47
Most promising solution	.94
Final plan	.98
Total score	.97

Table 3

Means and Standard Deviations for Component Scores: Experimental Group and Control Group

Component	Possible Score	Experimental Group Mean	SD	N	Control Group Mean	SD	N
		Experimental Group					
1	50	17.67	9.12	33	9.83	7.13	28
2	20	14.50	4.13	33	9.40	4.78	28
3	170	20.25	12.71	33	7.71	6.93	28
4	20	13.04	6.50	33	6.51	4.98	28
5	20	8.47	6.16	33	8.31	4.81	28
6	10	2.94	3.41	33	2.97	2.14	28

Table 4

Analysis of Variance of the Differences Between Experimental and Control Groups on Component Scores of the Future Problem Solving Process

Component	F
1. Problem identification	17.72*
2. Statement of the problem	27.67*
3. Alternative solutions	30.11*
4. Evaluation of solutions	20.24*
5. Most promising solution	.01
6. Final plan to gain acceptance	.01

*$p < .05$